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sanding will bring the necessary conditions for healthy plants, and the old plants may outgrow the trouble with the aid, in the meantime, of the remedy proposed. The best thing to do will be to try and see, upon a small area, provided the practical pecuniary test of possible profit prompts the owner. Some bogs are so poorly adapted for this peculiar industry that it will not pay to spend money upon them, others, nevertheless, merit much more attention than they receive.

THE GALL-FUNGUS.

This appears to be confined to a single bog in New Jersey, but in that one it is disastrous. Several closely related shore plants as azalea, sheep laurel, lambkill, white alder, leather leaf, huckleberry, and tea berry or winter green, are attacked by the same fungus (*Synchytrium Vaccinii*, Thomas). The disease is spread by the water in the spring floods and does not pass readily through the air. There is some danger, however, of the pest spreading to other bogs and therefore if this bog was destroyed by fire, together with the infested shore plants there might be hope for a speedy end to the trouble. The matter is so local that it does not merit further treatment here.

The two diseases of the cranberry herein briefly treated are considered at length, with several engravings, in Bulletin 64 of the New Jersey Experiment Station.

RUTGERS COLLEGE, NEW BRUNSWICK, N. J.

TREATMENT OF APPLE SCAB.

BY E. S. GOFF.

Recent experiments indicate that apple scab (*Fusicladium dendriticum*, Fckl.) may be almost entirely prevented by the application of certain liquid preparations, in the form of a spray, that, while harmless to the foliage and fruit of the tree, are destructive to the fungus which causes the disease. Various substances have been found to be more or less beneficial, but at the present state of our knowledge, a solution of copper carbonate in ammonia largely diluted with water is to be most strongly recommended. Experiments conducted, the past season, in the orchard of Mr. A. L. Hatch, of Ithaca, Wis., with this preparation proved so far satisfactory that Mr. Hatch has decided to apply the treatment to his entire orchard of about 25 acres the coming season, as a means of increasing the income from his apple trees.

DIRECTIONS FOR PREPARING AND APPLYING THIS FUNGICIDE.

The copper carbonate and the ammonia may be procured through almost any retail druggist. As the former is not always kept in stock it would be well to order it some days before it is desired for use. The copper carbonate should be of the "precipitated" form, and is worth at retail about 65 cents per pound. The ammonia should be of a strength of 22° Baumé, and should be procured in a glass or earthen vessel and kept tightly corked, preferably with a rubber cork.

Four ounces of the copper carbonate and 1 gallon of ammonia will be sufficient to give about fifty large or seventy-five medium-sized trees one thorough spraying. As four or five treatments will be needed for a thorough application of the remedy the amount of the materials required for any given orchard may be readily computed.

The best formula that can be given in the present state of our knowledge is to dissolve one ounce of the copper carbonate in one quart of ammonia, and dilute this, when ready to commence the application, with 25 gallons of water.

WHEN TO MAKE THE APPLICATIONS.

In the experiments made the past season in Mr. Hatch's orchard the first application was made after the petals of the flowers had fallen, and when the young apples were slightly larger than peas. But it is the opinion of Mr. Hatch and myself that one spraying before the flowers had opened would have proved beneficial. I would recommend, therefore, one treatment just before the flowers open, a second after the petals have entirely fallen, and others at intervals of two or three weeks until midsummer, or after, if the latter part of summer should be wet.

APPARATUS FOR SPRAYING.

For applying the liquid to the trees, a force-pump, to which is attached a few feet of hose, fitted at the end with a spraying nozzle, will be needed. Excellent pumps are now made by the larger manufacturers expressly for spraying purposes, fitted with all necessary attachments, and costing $10 and upwards. Smaller pumps, which would answer fairly well for a few trees, may be had at from $2 to $10 each.

The same pump which is used for treating the trees for the apple scab may of course be used for applying poisons for the codling moth and other insects. Unfortunately it will not be prudent to add the copper carbonate solution to the same water that is used in applying Paris green or London purple, as the ammonia renders the arsenic more or less soluble and thus the latter would be liable to injure the foliage. But if applied a few hours in advance of the water containing the arsenites, no harm can result from this source.

SUGGESTIONS FOR FURTHER EXPERIMENTS.

The time at which the applications should commence, the number that should be made, and the amount of copper carbonate to be used to accomplish the greatest benefit at the least cost, remain to be settled by experiment.

The most practical remedy for the apple scab must be one that may be applied in the same water with Paris green or London purple without thereby endangering the foliage. It is the opinion of our station chemist, Dr. Babcock, that not only the ammoniacal copper carbonate, but the sodium hyposulphite and the sulphides of lime and potash, all tend to render the arsenic of Paris green and London purple soluble, and hence can not be wisely used in connection with these poisons. The copper carbonate, however, which in the ammoniacal solution is the beneficial agent in preventing the apple scab, does not have this effect when used without the ammonia. The question therefore arises, is the ammonia solvent necessary?

I have recently made some tests with a sample of commercial precipitated copper carbonate, and find that its state of division is such that it remains suspended in water rather better than Paris green, and so may be applied by any apparatus that successfully distributes the latter. It apparently adheres to the foliage nearly or quite as well, when applied in simple suspension, as in the diluted ammoniacal solution.

I recommend, therefore, that those who spray their apple trees for the prevention of injury from the codling moth, make the experiment in a portion of the orchard of adding the precipitated copper carbonate to the water, at the rate of an ounce to twenty-five gallons. No harm to the foliage can result from this measure, while we have every reason to expect that much benefit will accrue in the prevention of the apple scab.

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THE COPPER SALTS AS FUNGICIDES.

BY F. D. CHESTER.

In order to make an intelligent comparison between the several well known fungicides containing copper, it is important to understand what salts of copper occur in each and in what relative proportions. This in turn involves some inquiry into the chemical reactions which take place in their preparation and during their stay upon the vine.

For much valuable assistance in the preparation of these notes I am indebted to Prof. C. L. Penny, the Chemist of this Station.

THE BORDEAUX MIXTURE.

Formula.—Copper sulphate, 6 pounds; lime, 6 pounds; water, 22 gallons. In the addition of milk of lime to a solution of copper sulphate, the lime in solution precipitates the copper as cupric hydroxide, forming at the same time a slightly soluuble sulphate of lime. These two salts, together with an excess of lime, remain in suspension in the Bordeaux mixture.